

Report to the North Pacific Fishery Management Council
on the 2014
Bering Sea Pollock Intercooperative Salmon Avoidance
Agreement

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This report is to the North Pacific Fishery Management Council and covers the Bering Sea and Aleutian Islands Management Area (BSAI) Pollock Intercoop Salmon Avoidance Agreement (“ICA”). During the course of the B season fishery, the pollock Intercoop closed 63 areas to fishing based on high bycatch rates of chum salmon experienced by vessels working in the area. Maps of the closures are shown in Figure 1.

Under the terms of the ICA, applicants are to submit to the Council a report analyzing:

1. Estimated number of salmon avoided as demonstrated by the movement of fishing effort away from salmon hot-spots.
2. A compliance/enforcement report that will include the results of an external audit designed to evaluate the accuracy of the approach used by Sea State to monitor compliance with the agreement, and a report on the effectiveness of enforcement measures stipulated under the ICA in cases of non-compliance. Examination of a randomly selected subset of vessel/days representing 10% of the catch during each season will be used as the basis of the audit.

Number of non-Chinook salmon taken during the fishery:

For the sake of comparison we have included catch and bycatch amounts running back to 1993. These data are compiled from plant landing information for catcher vessels delivering to shoreside processors, and observer data for mothership catcher vessels and catcher-processors. The “other salmon” category includes all non-chinook salmon. Observer data for both offshore and shoreside deliveries show only very small numbers

of salmon other than chum in this category (for example, 152 unidentified, 31 pinks, and 5 silvers for the 2006B season EFP).

Table 1. Catch and bycatch of pollock and “other” salmon in the directed pollock fishery B season, 1993 – 2014.

Year	B season pollock*	B season other salmon bycatch
1993	740,569	242,473
1994	718,582	89,117
1995	647,865	17,625
1996	633,639	77,028
1997	546,988	64,504
1998	539,432	60,040
1999	511,211	44,261
2000	631,755	57,228
2001	813,022	50,948
2002	866,034	83,033
2003	876,784	170,688
2004	858,799	427,234
2005	878,618	637,957
2006	874,435	276,779
2007	775,261	82,641
2008	572,384	14,453
2009	469,128	38,040
2010	471,983	13,585
2011	681,480	191,517
2012	705,716	22,149
2013	738,693	124,661
2014	745,808	217,572

** For the years 1993-1999, total groundfish from P and B targets, available on files from NMFS site (below), were used instead of pollock.*

Estimates of salmon bycatch for 1993-1999 are for all P and B trawl target fisheries, including CDQ, and are available on the NOAA Fisheries, AK Region web site. (<http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm>)

Evaluation of salmon savings.

The evaluation of the number of salmon saved by the IC program is based on tracking vessels that fished in a closed area before it closed, and then comparing their subsequent bycatch to see if it was lower than expected if the area had not closed. Put more simply, we perform a before-and-after comparison of the bycatch observed and expected from the vessels that triggered the closure. The procedure is as follows:

1. Extract all observer data for haul locations falling inside a closure area, for a 5 day period preceding the closure. For shoreside catcher vessels, aggregate the hauls that have the same “start fishing date” so that hauls with the same bycatch rate are not artificially repeated. As an example, if 2 hauls from the same catcher vessel trip show up in the closed area, they will have the same bycatch rate because observers pro-rate bycatch evenly across all hauls. Consider them a single observation with a value equal to the sum of the two hauls’ pollock and salmon.
2. Consider all of independent offshore sector (C/P and mothership) hauls, and combined “trip-level” hauls to be estimates of the bycatch ratio $R_i = \sum y_i / \sum x_i$, where y are counts of chinook or chum salmon, and x is the pollock catch from individual hauls (offshore sector) or grouped, same-trip hauls (shoreside), and i indicates a separate closure.
3. Extract the same haul or “grouped” haul information, for the same vessels, for the duration of the closure (either 3 or 4 days). Their associated bycatch is available from either observer or plant delivery information. Compute their expected bycatch had they been able to stay and fish inside the now-closed area, by summing the pollock catch of all vessels in this category, and multiplying this summed pollock catch by the matching bycatch ratio, R_i above.
4. Compute the standard error of this estimated Y (overall salmon bycatch if vessels had stayed in the area and fished with bycatch rate R) treating R as a ratio estimator (Snedecor and Cochran, Statistical Methods, 8th Edition, p 452).

Avoidance results from the 2014 Intercoop Agreement

Locations of the 2014 closures are shown in Figure 1.

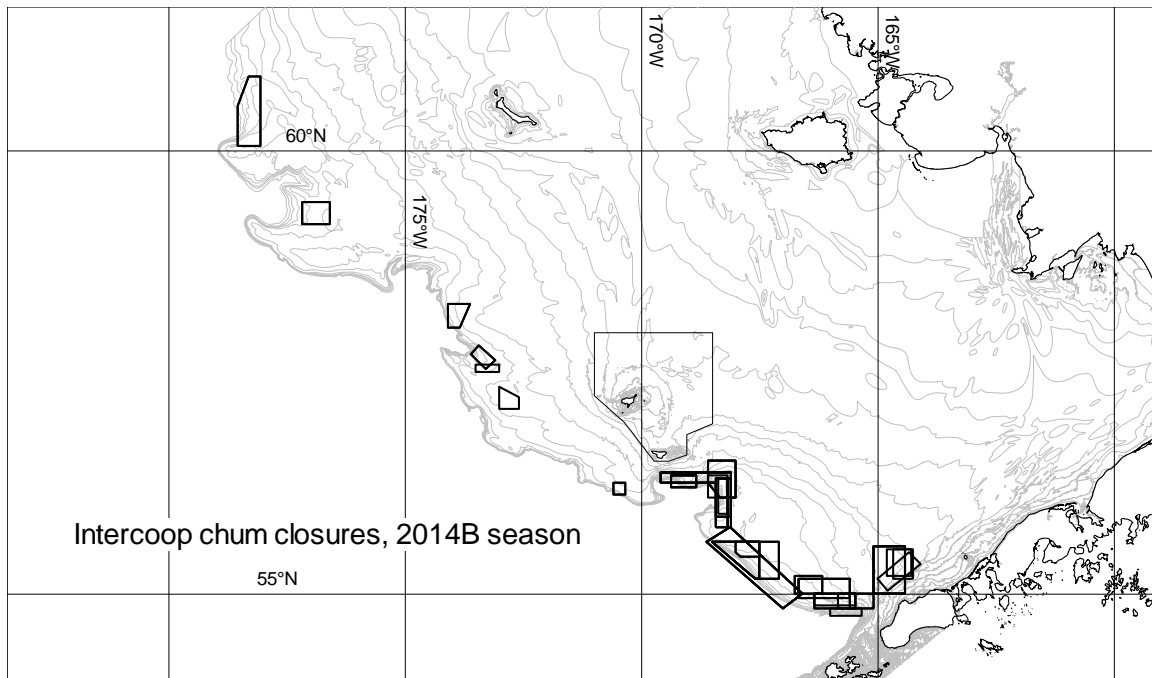


Figure 1. 2014 IC chum closures

Table 2 summarizes the results for both chum and chinook savings resulting from these closures (Appendix Tables A1 and A2 show the underlying data, by closure, with associated standard errors). A total of 33,088 mt of pollock was associated with boats that fished inside areas before they were closed. These same vessels caught 65,232 mt of pollock in the closure interval following the associated closure date. An estimated 57,938 fewer chum were taken outside the closures than would have been expected if the same amount of pollock had been taken inside the closures, based on the comparison of rates inside and outside closure areas. Chinook reduction was not significant: 209 were taken outside the chum closures versus an estimated 239 that would have been caught at within-closure rates, or a reduction of 30 chinook. These bycatch reductions represent a 58% decrease in expected chum bycatch (for boats that fished in closures, for the 3 or 4 day period after the closure), and a 13% decrease in expected chinook bycatch.

Table 2. Chum salmon closure effectiveness for the 2014 B season

Closure statistic	Bycatch species	
	Chinook	Chum
Pollock catch (inside, before closures)	33,088	65,232
Pollock catch (outside, after closures)	33,088	65,232
Actual bycatch (outside, after closures)	209	42,582
Expected bycatch (at pre-closure rate)	239	100,520
Savings	30	57,938
% reduction	13%	58%

A comparison with results from chum closures from previous years is shown in Table 3. The “After-closure pollock” column shows the total tonnage of pollock harvested after closures by vessels that fished inside closures during the closure duration (3 or 4 days, depending on the day of closure). This amount of pollock can be viewed as having been moved from inside the closure area to outside due to the closures. The 2014 amount (65,232 mt) is relatively large, which is expected since chum bycatch was high with a corresponding large number of closures. The chum savings estimated by the methods outlined are likely to be very conservative, as they do not account for any change in behavior of vessels that did not fish in closures in the 5 day period preceding the closure announcement. The estimated 21% reduction in chum catch for the entire fishery (Table 3) in 2014 is slightly less than the long term average of 26%. Chum-related closures continued through September 30, which is 2 weeks earlier than the last closure of the prior year. Later closures were not necessary as the pollock fishery was essentially concluded before October 1.

Table 3. Comparison of the effects of chum closures across years.

Year	After-closure pollock	% of harvest affected	Chinook savings	Chinook % reduction	Chum savings	% reduction	Actual chum catch	Percentage reduction
2006	23,049	3%	-97	-21%	65,299	64%	276,779	19%
2007	107,646	14%	2007	56%	75,970	82%	82,641	48%
2008	3,448	1%	53	82%	768	73%	14,453	5%
2009	5,701	1%	52	50%	6,270	76%	38,040	14%
2010	12,537	3%	61	85%	1,808	84%	13,585	12%
2011	146,846	22%	73	7%	79,657	63%	191,517	29%
2012	12,246	2%	48	11%	3,530	50%	22,149	14%
2013	49,818	7%	1051	74%	34,231	65%	124,661	22%
2014	65,232	9%	9	13%	57,938	58%	217,572	21%
Totals					325,471		981,397	25%

Compliance/ Enforcement

No violations were referred to coops for enforcement actions. An audit of Sea State compliance monitoring has again been awarded to ABR Inc of Fairbanks, Alaska. ABR reviewed 10% of the coop fishing records and associated VMS information. The report for this audit states that:

“ABR agreed with the determinations of Sea State for the 10% sample that we examined, and we found no closure zone violations. Of points examined, our determination agreed with Sea State for all 9,986 locations in our subsample. We did discover missing location data for three vessels fishing during the season. Because of this, we were unable to assess whether these hauls were in compliance with the closures that applied to them.”

Gaps in VMS data were reported to ABR by Sea State in advance of the audit. These gaps occur as units either fail in the field or have failed and been replaced without vessel owners having notified Sea State of their replacement. There is always a delay associated with Sea State's ability to track vessels once new equipment is installed, and for this reason vessels participating in the IC agreement have 30 days to facilitate receipt of new data by Sea State. This generally involves filling out new authorization forms if a vessel switches to a different VMS manufacturer, and/or Sea State's working with the provider in question to restore data flow. Since the fishery is 100% observed it is possible to examine observer data to determine basic compliance; while not as good as VMS data, in these cases it was clear that vessels were operating well away from closures. We suggested this sort of check to ABR, but not in time for them to incorporate a new method into this report; presumably they will do so in the future if we again have gaps in coverage.

Comparison of the 2014 chum ICA program with previous years.

Comparison of the chum bycatch program with actions of the chum bycatch program from previous years is best confined to 2011 onward, since at that point Amendment 91 mandated a census count of chum salmon. Also, from that point onward all vessels were required by their chinook IPAs to stay under chinook caps, and those caps may have influenced behavior towards chums.

Figure 2a shows that in 2014, salmon closures were concentrated along the outer shelf to a degree not seen in previous years. Perhaps the greatest contrast is with the series of closures from 2011. In both years bycatch was very high, but 2011 closures were along the 55 fm line, while 2014 closures markedly were generally along the shelf edge south of the Pribilofs. During the 2014B season, pollock vessels found almost no fish along the 55-fm line, so fishing activity was greater near the shelf-edge. This pattern was abnormal but may be of use in determining the susceptibility of western Alaska chums in the pollock bycatch. However, current chum bycatch stock composition estimates are being made at levels corresponding to reporting areas (eg 509, 517, etc), and reporting areas are often not aligned with the usual fishing areas for the pollock fishery. High numbers of chums taken along the shelf edge as in 2014 will be lumped with chums taken closer to

Unimak Pass in area 517 and any differentiation of stock by these areas will be lost by their being lumped in area 517.

Figures 3 and 4 show pollock and chum catch by day from 2011 - 2014. Fishing for pollock was over by October 4, with the last shoreside activity on 9/24, last mothership activity 9/28, and last C/P activity on 10/4. In recent years all sectors have tried to be off the grounds as early as possible to avoid the increase in chinook bycatch rates that are typically seen in October. To accomplish this they have had to increase catches earlier in the B season, and these higher catch rates are apparent in Figure 4. Increasing pollock catch rates in August and September has likely led to the increase in chums seen in 2014. Figures 3a and 3b indicate that while chum bycatch was higher in September of 2014, chum bycatch rates were not appreciably different than in, say, 2011.

Figures 5 and 6 show where most pollock and chum were taken over the 2011 - 2014 period. In these figures both pollock catch and chum bycatch were summed for .1 deg latitude and longitude regions, and scaled as indicated on the legends (larger circles indicate larger catches). It appears that over the years the catcher vessel fishery has shifted away from the 55-fm line on the mid-shelf and out towards the shelf edge, although significant catches down near Unimak Pass and up to the northwest also occur. This move is certainly in response to changing patterns of pollock distribution, and is anecdotally related to a warming of the waters over the mid-shelf in summer. Chum bycatch has also shifted towards the shelf edge, although in 2011 there were significant chum catches near the edge as well. Closures were not place along the shelf edge in 2011 because bycatch rates along the 55-fm line were higher. Again, it would be of interest to see if this band of chum that appear to be consistent along the shelf edge have a stock composition that differs from chums taken along the more traditional area of the mid-shelf.

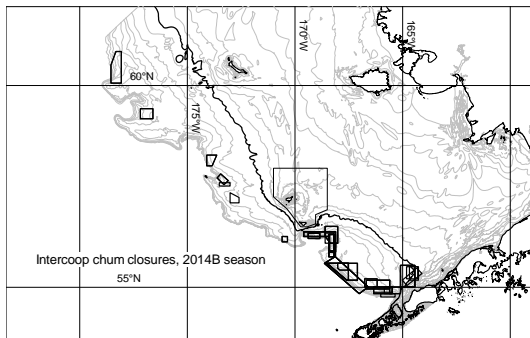


Figure 2a. 2014 Chum closures areas (63 closures), 55-fm contour in bold, 217,572 chums taken

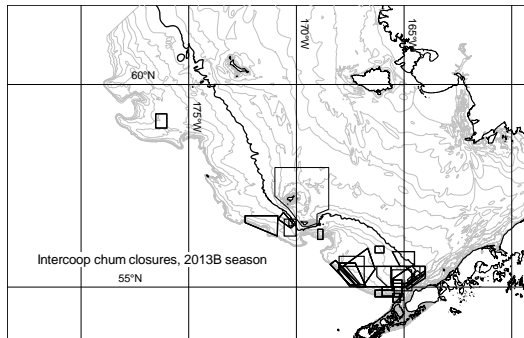


Figure 2b 2013 Chum closures areas (52 closures), 55-fm contour in bold, 124,661 chums taken

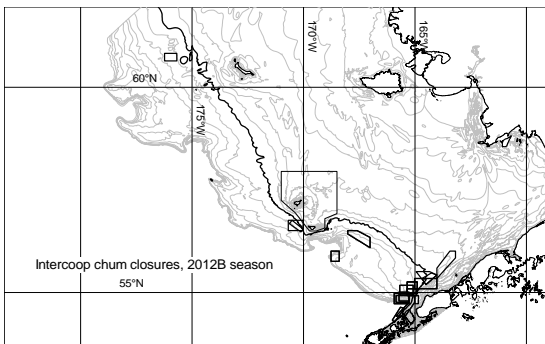


Figure 2c. 2012 Chum closures areas (32 closures), 55-fm contour in bold, 22,149 chums taken

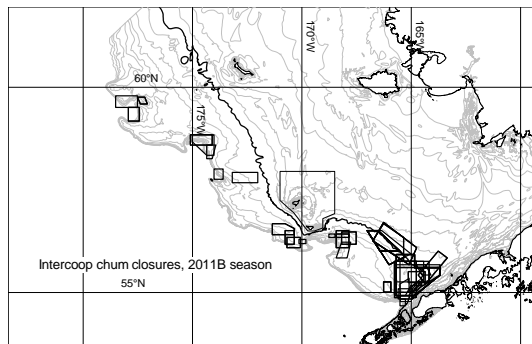


Figure 2d. 2011 Chum closures areas (70 closures), 55-fm contour in bold, 191,517 chums taken

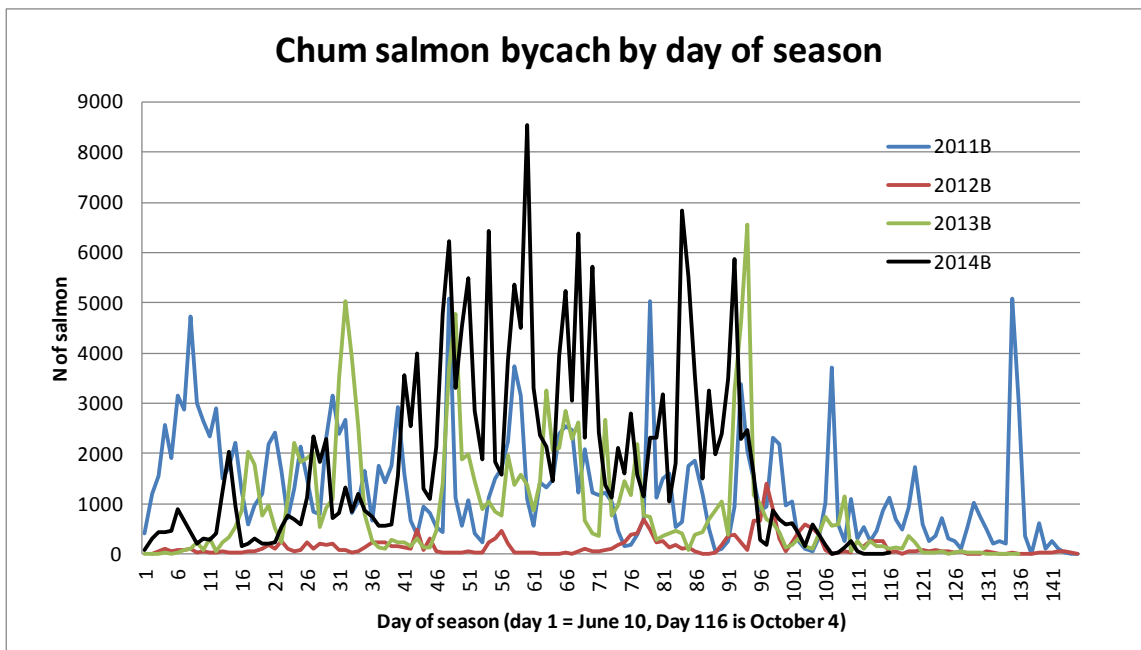


Figure 3a. Chum bycatch by day of season, 2011 - 2014

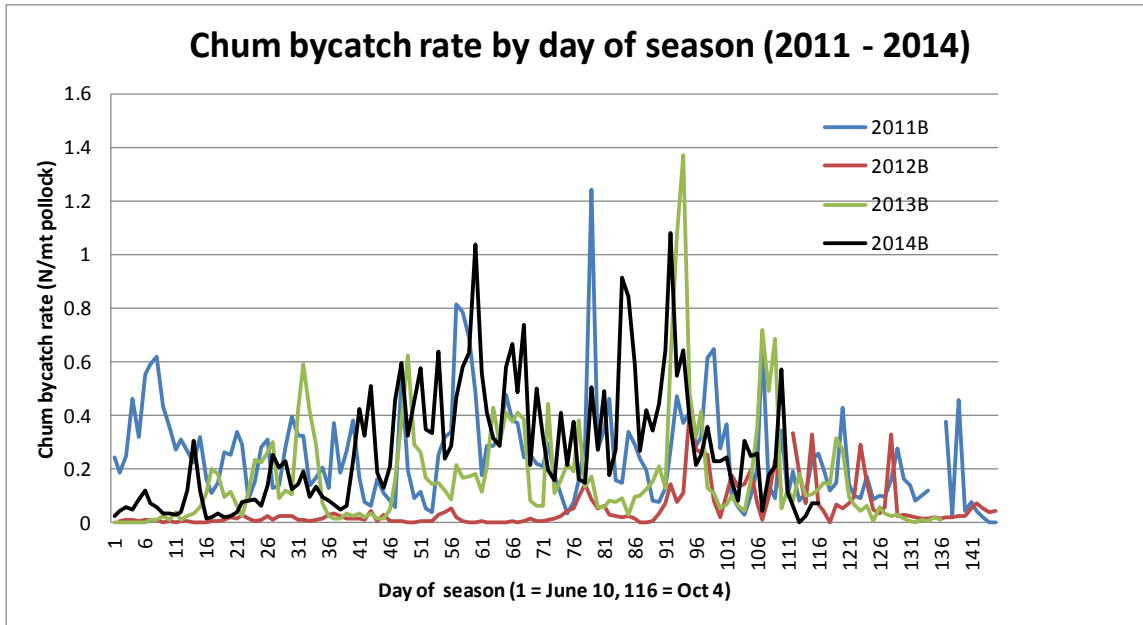


Figure 3b. Chum bycatch rates by day of season, 2011 - 2014. Several very high rates for days in late October of 2011 were removed to allow for better detail at lower rates (i.e. less range on the vertical axis).

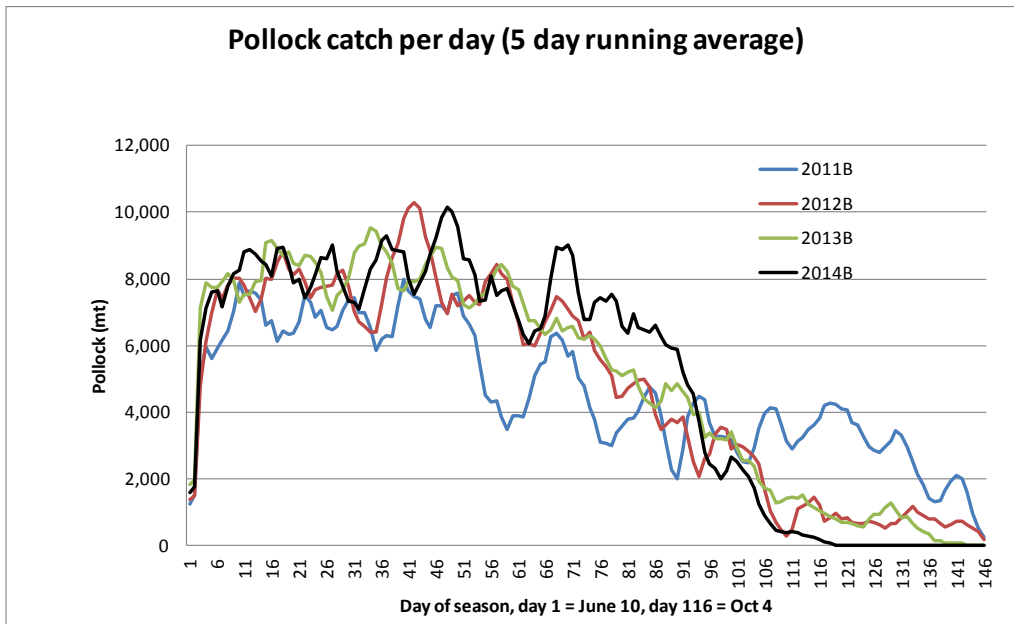


Figure 4. Pollock catch by day of season, 2011 - 2014

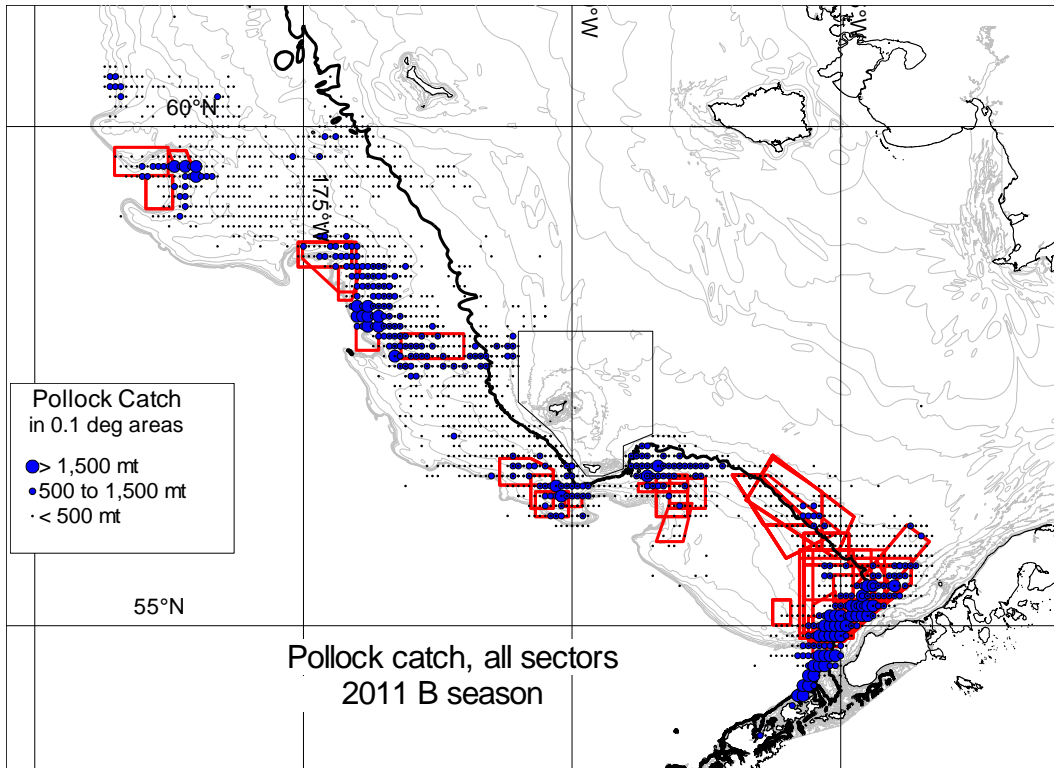


Figure 5a. Pollock catch for 2011 summed at .1 deg resolution

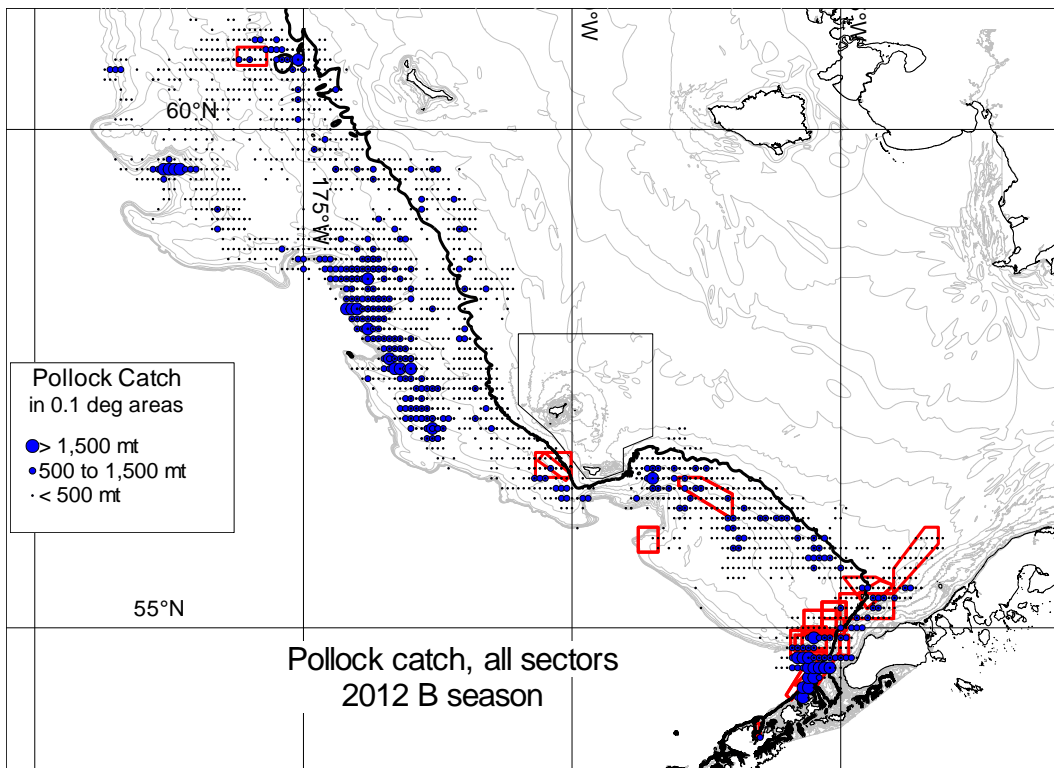


Figure 5b. Pollock catch for 2012 summed at .1 deg resolution

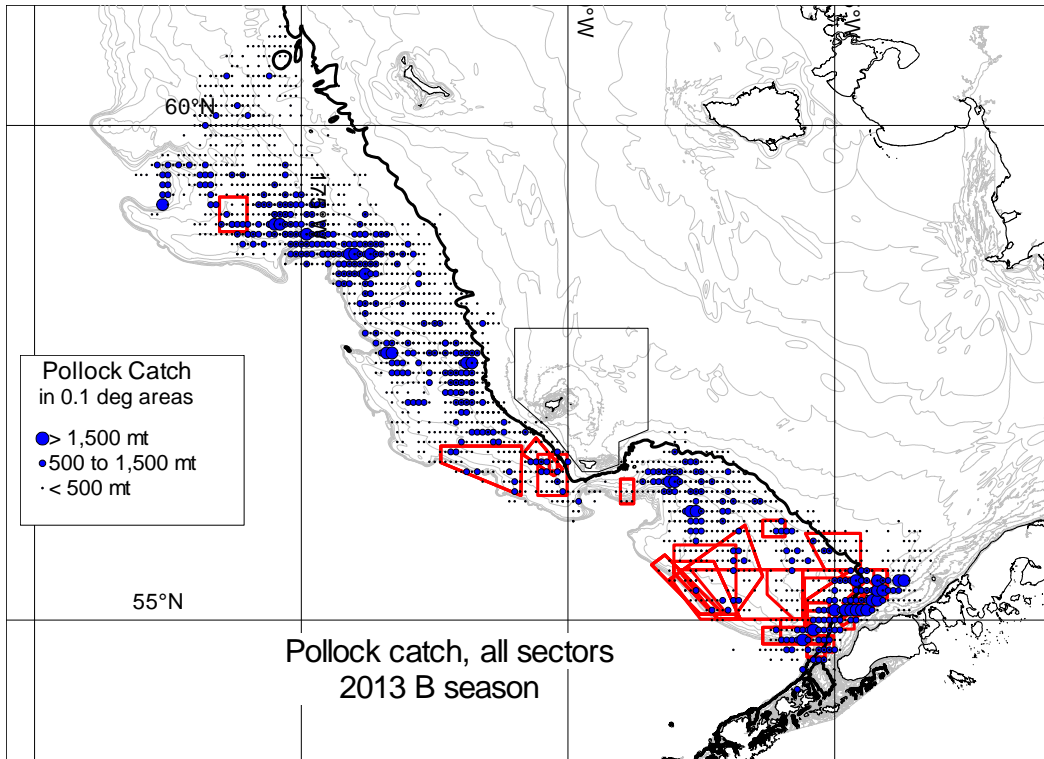


Figure 5c. Pollock catch for 2013 summed at .1 deg resolution

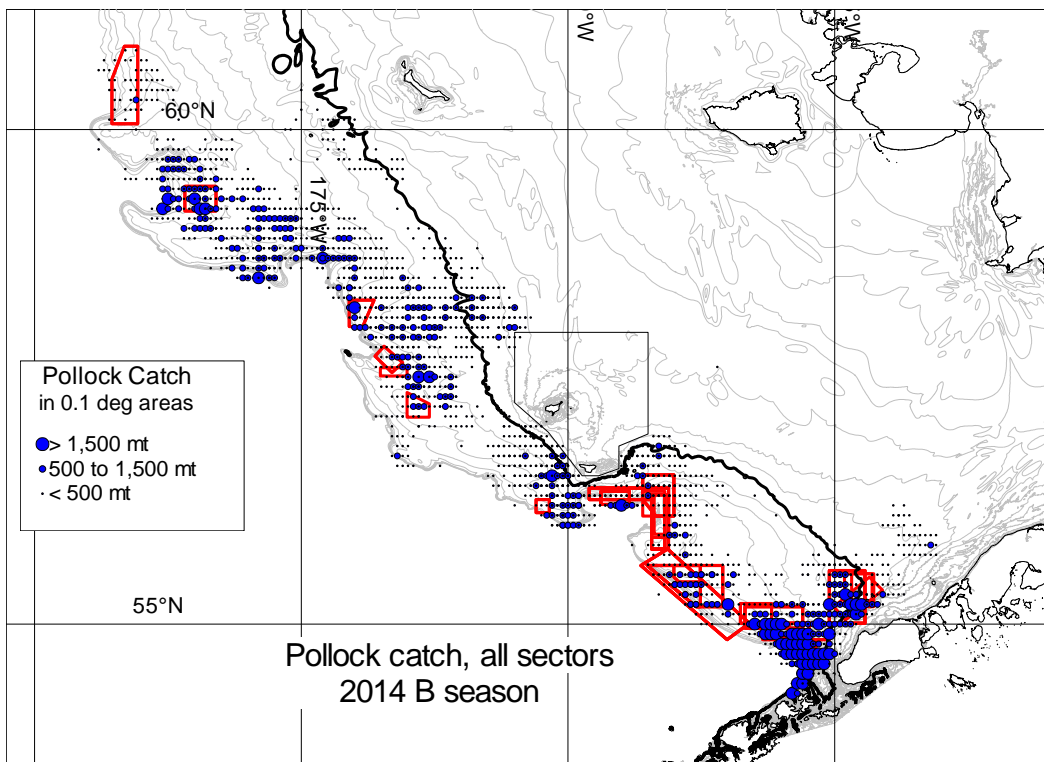


Figure 5d. Pollock catch for 2014 summed at .1 deg resolution

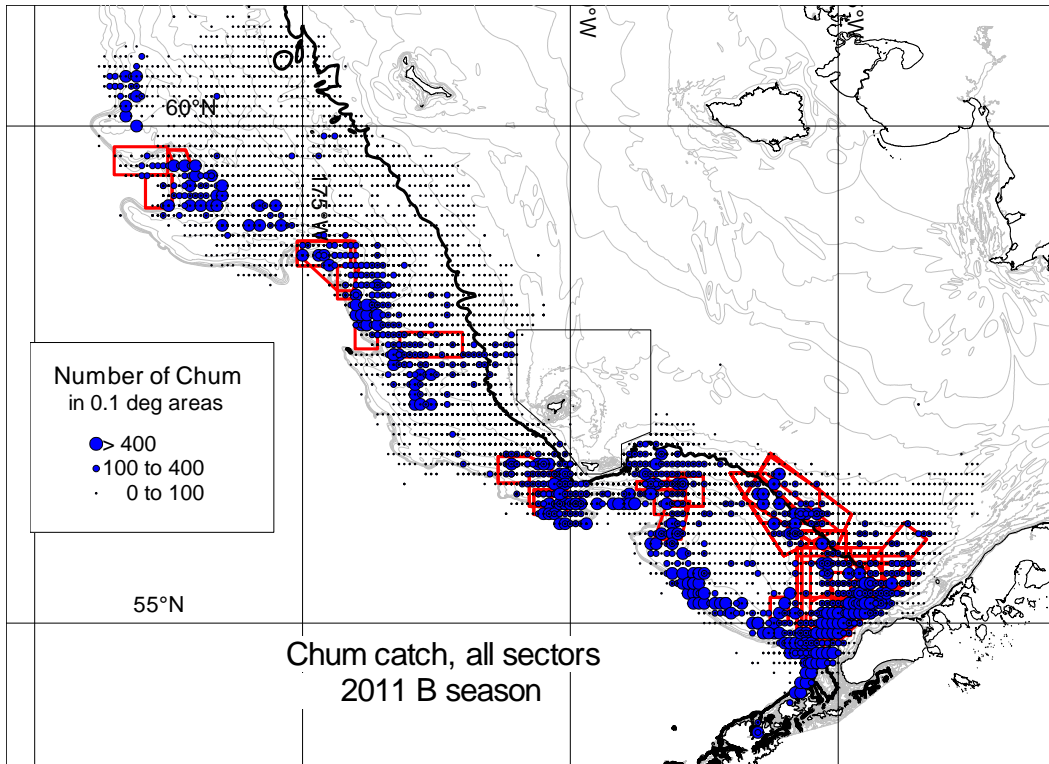


Figure 6a. Chum catch for 2011 summed at .1 deg resolution

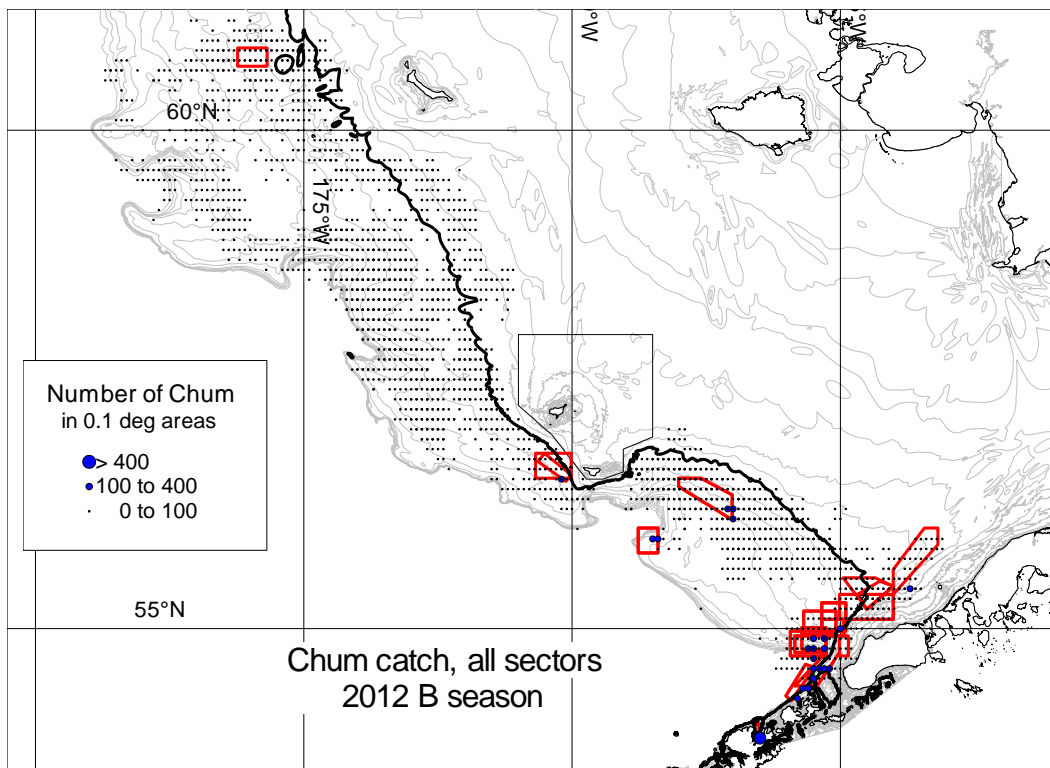


Figure 6b. Chum catch for 2011 summed at .1 deg resolution

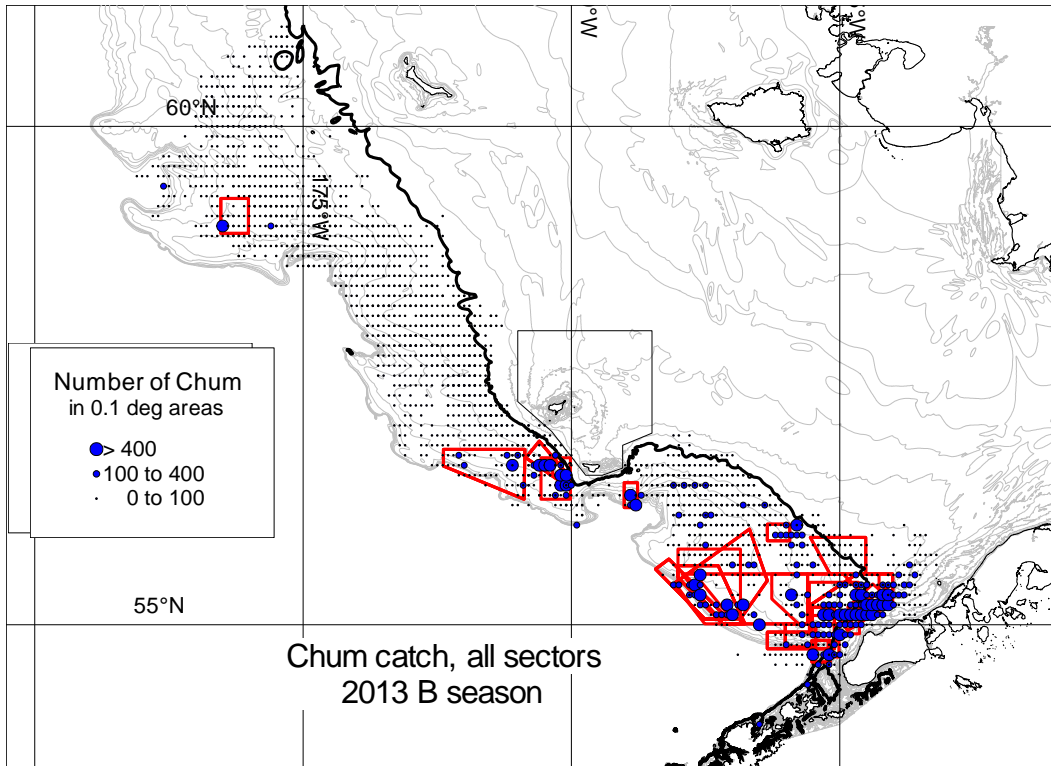


Figure 6c. Chum catch for 2013 summed at .1 deg resolution

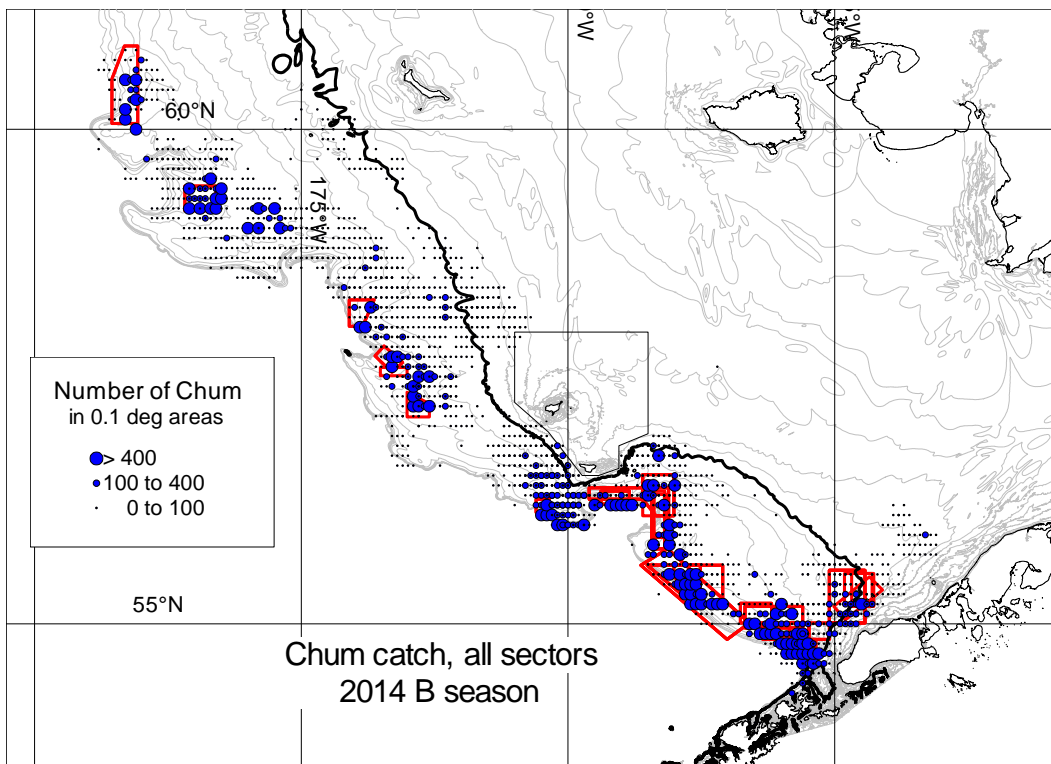


Figure 6d. Chum catch for 2014 summed at .1 deg resolution

Appendix 1. Before-and-after closure fishing comparisons, by closure.

Table A1. Chum savings by closure

Date	Pollock catch (mt) in closures, prior to closure	Chum rate in closure (N/mt)	Chum rate after closure	Displaced pollock (mt)	Actual chum bycatch (N)	Est chum bycatch at closure rate	Chum reduction (estimate - actual)	N Before hauls (N in closure)	N After hauls	Std err of estimated chum bycatch at closure rate
07/08/14	3,729	0.41	0.34	3,391	1,157	1,406	249	63	51	94.8
07/11/14	449	0.64	0.36	1,777	645	1,141	496	7	29	35.5
07/15/14	1,499	0.65	0.10	3,246	310	2,098	1,788	25	52	98.2
07/18/14	208	1.44	0.41	901	372	1,298	926	7	20	78.2
07/22/14	32	1.64	3.52	36	127	59	-68	1	1	
07/25/14	4,993	0.26	0.99	5,595	5,515	1,432	-4,083	48	89	242.2
07/25/14	778	1.80	0.07	5,474	391	9,830	9,439	11	64	478.3
07/25/14	2,002	1.34	1.35	3,516	4,763	4,712	-51	23	56	710.8
07/29/14	1,533	0.23	0.29	1,193	344	278	-66	16	13	58.1
07/29/14	132	1.41	0.17	286	50	403	353	1	2	
08/01/14	2,050	1.75	0.93	6,440	6,006	11,293	5,287	28	75	496.5
08/08/14	902	1.38	0.77	2,123	1,643	2,931	1,288	16	40	193.1
08/08/14	1,349	2.92	0.21	1,414	296	4,125	3,829	15	17	663.7
08/08/14	401	2.79	1.81	555	1,006	1,548	542	4	5	173.1
08/12/14	1,630	4.29	1.66	2,146	3,552	9,210	5,658	28	30	1,540.0
08/12/14	843	1.71	0.98	1,441	1,408	2,459	1,051	8	22	148.3
08/15/14	49	0.51	2.93	163	477	83	-394	1	5	
08/15/14	4	4.79	0.13	509	64	2,439	2,375	1	6	
08/19/14	241	4.79	0.23	525	122	2,516	2,394	6	10	306.9
08/19/14	230	6.20	0.03	245	7	1,518	1,511	4	3	36.2
08/19/14	630	3.43	0.22	1,398	308	4,793	4,485	5	11	188.3
08/22/14	1,959	0.51	0.23	7,072	1,602	3,617	2,015	14	65	166.5
08/29/14	49	1.64	1.90	508	966	832	-134	2	8	31.5
08/29/14	378	4.16	0.95	4,171	3,947	17,349	13,402	7	43	452.2
09/02/14	215	0.88	1.35	619	835	548	-287	2	6	177.4
09/05/14	1,279	1.44	1.18	1,832	2,156	2,637	481	13	16	240.3
09/05/14	3,407	1.30	0.92	4,391	4,035	5,690	1,655	33	45	123.9
09/12/14	818	4.11	0.13	581	76	2,386	2,310	9	10	164.0
09/19/14	1,154	0.30	0.07	2,492	172	739	567	15	31	85.9
09/26/14	145	0.97	0.19	1,191	230	1,152	922	3	15	31.8
Totals	33,088			65,232	42,582	100,520	57,938	416	840	

Table A2. Chinook savings by closure

Date	Pollock catch (mt) in closures, prior to closure	Chinook rate in closure (N/mt)	Chinook rate after closure	Displaced pollock (mt)	Actual chinook bycatch (N)	Est chinook bycatch at closure rate	Chinook reduction (estimate - actual)	N Before hauls (N in closure)	N After hauls	Std Err chinook estimate
07/08/14	3,729	0.001	0.001	3,391	2	2	0	63	51	0.73
07/11/14	449	0.002	0.003	1,777	5	4	-1	7	29	0.79
07/15/14	1,499	0.000	0.000	3,246	0	0	0	25	52	0.00
07/18/14	208	0.010	0.002	901	2	9	7	7	20	1.76
07/22/14	32	0.000	0.000	36	0	0	0	1	1	
07/25/14	4,993	0.001	0.001	5,595	8	4	-4	48	89	3.45
07/25/14	778	0.005	0.000	5,474	0	28	28	11	64	1.23
07/25/14	2,002	0.005	0.001	3,516	3	18	15	23	56	3.30
07/29/14	1,533	0.000	0.001	1,193	1	0	-1	16	13	0.00
07/29/14	132	0.000	0.000	286	0	0	0	1	2	
08/01/14	2,050	0.000	0.000	6,440	3	3	0	28	75	1.40
08/08/14	902	0.000	0.001	2,123	2	0	-2	16	40	0.00
08/08/14	1,349	0.000	0.001	1,414	1	0	-1	15	17	0.00
08/08/14	401	0.000	0.000	555	0	0	0	4	5	0.00
08/12/14	1,630	0.001	0.001	2,146	2	3	1	28	30	1.21
08/12/14	843	0.002	0.003	1,441	5	3	-2	8	22	0.51
08/15/14	49	0.020	0.000	163	0	3	3	1	5	
08/15/14	4	0.000	0.000	509	0	0	0	1	6	
08/19/14	241	0.004	0.013	525	7	2	-5	6	10	0.79
08/19/14	230	0.000	0.012	245	3	0	-3	4	3	0.00
08/19/14	630	0.000	0.001	1,398	2	0	-2	5	11	0.00
08/22/14	1,959	0.002	0.002	7,072	13	11	-2	14	65	0.59
08/29/14	49	0.020	0.006	508	3	10	7	2	8	0.81
08/29/14	378	0.005	0.004	4,171	15	22	7	7	43	0.86
09/02/14	215	0.000	0.010	619	6	0	-6	2	6	0.00
09/05/14	1,279	0.012	0.021	1,832	39	21	-18	13	16	2.15
09/05/14	3,407	0.002	0.000	4,391	1	9	8	33	45	0.34
09/12/14	818	0.001	0.009	581	5	1	-4	9	10	0.11
09/19/14	1,154	0.028	0.020	2,492	51	69	18	15	31	5.80
09/26/14	145	0.014	0.025	1,191	30	16	-14	3	15	0.09
Totals	33,088			65,232	209	239	30	416	840	

Appendix 2: Dirty 20 list appearances

Number of times each vessel was on a 2014 chum weekly dirty 20 list. (M) after vessel name indicates vessel was fishing in the mothership coop. Dual-qualified CVs may appear twice if they fished shoreside and delivered to a mothership.

Vessel	# of times on the dirty 20	# of weeks fishing in 2014B	Vessel	# of times on the dirty 20	# of weeks fishing in 2014B	Vessel	# of times on the dirty 20	# of weeks fishing in 2014B
Alaska Ocean	1	12	Excalibur II	2	7	Pacific Challenger	0	2
Alaska Rose	2	12	Fierce Allegiance	6	9	Pacific Challenger (M)	0	9
Aldebaran	5	14	Gladiator	3	11	Pacific Explorer	7	15
Aleutian Challenger (M)	0	5	Gold Rush	3	10	Pacific Fury (M)	1	9
Alea	2	11	Golden Dawn	0	13	Pacific Glacier	4	16
Alyeska (M)	1	2	Golden Pisces	3	15	Pacific Prince	3	15
American Beauty (M)	1	7	Great Pacific	3	12	Pacific Ram	2	2
American Dynasty	3	14	Gun-Mar	0	12	Pacific Viking	5	14
American Eagle	4	14	Hickory Wind	2	11	Peggy Jo	3	9
American Triumph	1	13	Island Enterprise	2	11	Poseidon	3	11
Anita J	4	12	Kodiak Enterprise	2	8	Progress	0	11
Arctic Explorer	2	5	Leslie Lee	4	10	Royal American	6	12
Arctic Fjord	2	15	Majesty	2	8	Royal Atlantic	3	12
Arctic Ram	2	6	Marcy J	0	6	Sea Wolf	0	7
Arctic Storm	1	12	Margaret Lyn (M)	1	13	Seadawn	4	12
Arctic Wind	0	2	Mark I	1	5	Seattle Enterprise	6	14
Arcturus	6	15	Mark I (M)	1	6	Sovereignty	5	14
Argosy	6	11	Misty Dawn (M)	1	14	Starbound	3	17
Auriga	1	14	Morning Star	6	14	Starfish	9	14
Aurora	2	14	Nordic Fury	0	7	Starlite	6	13
Bering Defender	0	14	Nordic Fury (M)	0	4	Starward	9	14
Bering Rose	3	11	Nordic Star	4	12	Storm Petrel	0	12
Bristol Explorer	7	13	Northern Eagle	2	14	Traveler	0	5
Caitlin Ann	5	13	Northern Hawk	0	10	Traveler (M)	0	6
Cape Kiwanda	1	8	Northern Jaeger	2	13	Vanguard	0	2
Chelsea K	6	14	Northern Patriot	7	15	Vanguard (M)	0	5
Collier Brothers	1	6	Northwest Explorer	0	3	Viking	3	13
Columbia	1	13	Ocean Explorer	8	15	Viking Explorer	3	11
Commodore	2	12	Ocean Hope 3	1	7	Walter N	1	5
Defender	3	13	Ocean Leader	0	3	Western Dawn	4	6
Destination	3	12	Ocean Leader (M)	1	4	Western Dawn (M)	1	7
Dominator	1	14	Ocean Rover	1	12	Westward I	5	13
Elizabeth F	2	5	Oceanic (M)	1	7			